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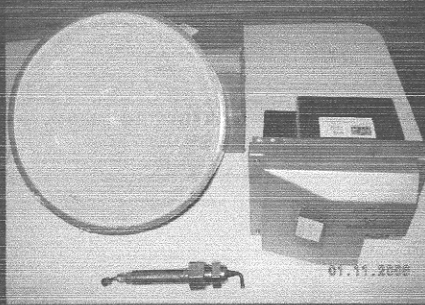
Selective Catalytic Reduction for Railway Locomotives

Presented to the
California Air Resources Board
January 27, 2006

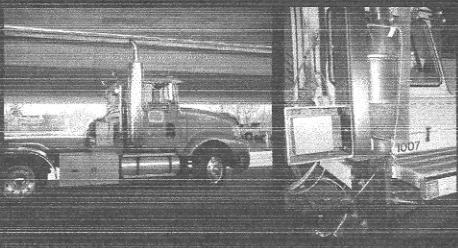


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President

Compact Urea SCR System for Mobile Sources



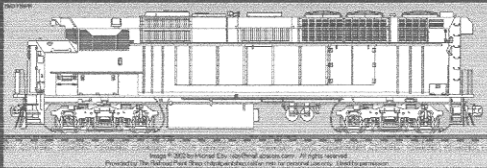
- EF&EE is working with European manufacturers to introduce compact SCR retrofit systems in the U.S.
 - Trucks
 - Commercial boats
 - Locomotives
 - Non-road equipment



Status of SCR for Locomotives

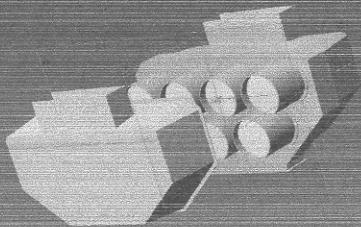
- Widely used on similar engines in stationary applications
- 1994 ARB report identified SCR as most cost-effective measure for locomotives
 - Conceptual design based on stationary SCR systems
- Railroads have strongly resisted SCR proposals
 - Cost
 - Volume requirements on locomotive
- New emission control system at Roseville rail yard will capture locomotive emissions in a stationary hood and apply SCR
- But, new compact SCR systems provide major improvements in both cost and space demand, would allow SCR control on-board

Locomotive Profile



- Exhaust system configuration on Metrolink F59s is the same as on SD60 freight locomotives
- Same SCR retrofit system could be used on both

SCR Catalytic Converter



Cost-Effectiveness of SCR in Metrolink Locomotives

	NOx	PM
Annual Emissions (tpy)	29.2	1.0
Emission Reduction (tpy)	23.4	0.5
Capital Cost	\$ 150,000	
Annualized	36,584	
Liters Urea/Year	42,048	
Operating Cost	\$ 47,048	
Total Annual Cost	83,632	
Cost-Effectiveness	\$ 2,949	\$/ton

SCR Application to Freight Locomotives

- SCR highly cost-effective
- More than half the cost is for urea consumption
 - Can be turned on and off when entering/leaving pollution control areas
 - Automatic control based on GPS
- Cost-effective NOx control for nonattainment regions
- PM benefits would be experienced throughout area of operation
